इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 9563 (1980): Carbon monoxide filter self-rescuers [CHD 8: Occupational Safety, Health and Chemical Hazards]

"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

BLANK PAGE

BRUTUM FULMEN
IGNORANTIA JURIS NON EXCUSAT
PROTECTED BY COPYRIGHT

IS : 9563 - 1980
Reaffirmed - 2012

Indian Standard

SPECIFICATION FOR CARBON MONOXIDE FILTER SELF-RESCUERS

UDG 614.894.29 : 622.867.3

© *Copyright* 1980

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
MEW DELHI 110002

December 1980

AMENDMENT NO. 1 OCTOBER 1998
TO
IS 9563 : 1980 SPECIFICATION FOR CARBON MONOXIDE FILTER SELF-RESCUERS

[*Page* 11, *clause* **4.3.3**, *Table* 1,*Sl No.* (ii), *col* 5) — Substitute '27°C *for* 'less than 3°C'.

(CHD 08)

Reprography Unit, BIS, New Delhi, India

Indian Standard

SPECIFICATION FOR
CARBON MONOXIDE FILTER SELF-RESCUERS

Industrial Safety Advisory Committee, ISAC

Chairman	*Representing*
SHRI A. K. CHAKRABARTY	Directorate General of Factory Advice Service and Labour Institutes (Ministry of Labour), Bombay
Members	
SHRI P. R. SURENDRANATHAN (*Alternate* to Shri A. K. Chakrabarty)	
SHRI BIMAL BANARJEE	Hind Mazdoor Sabha, Bombay
SHRI BACHA PRASAD (*Alternate*)	
SHRI SUSHIL BHATTACHARYA	United Trade Union Congress, Calcutta
SHRI PRATUL CHOWDHURY (*Alternate*)	
DR S. K. CHATTERJEE	Directorate General of Health Services, New Delhi
DR B. B. CHATTERJEE (*Alternate*)	
SHRI N. CHAWLA	Sandoz (India) Ltd, Thane
CHIEF MECHANICAL ENGINEER NORTHERN RAILWAY, NEW DELHI	Railway Board (Ministry of Railways), New Delhi
SHRI S. G. DEY	Central Boilers Board, New Delhi
SHRI B. K. DHAR	Builders' Association of India, Bombay
LT-COL D. K. GHOSE (*Alternate*)	
SHRI D. M. DHAR	Standing Committee on Safety for the Steel Industry, Durgapur Steel Plant, Durgapur
DIRECTOR (COMMERCIAL)	Central Electricity Authority, New Delhi
DEPUTY DIRECTOR (COMMERCIAL) (*Alternate*)	
DIRECTOR GENERAL OF MINES SAFETY	Directorate General of Mines Safety, Dhanbad
DIRECTOR (MINES SAFETY EQUIPMENT) (*Alternate*)	
SHRI K. H. GANDHY	Ministry of Defence (DGI)
SHRI SAT PAL SINGH (*Alternate*)	
SHRI S. K. JAGNANI	Indian Cotton Mills Federation, Bombay
SHRI R. P. JHA	Indian Jute Mills Association, Calcutta
SHRI J. D. JIJINA	Indian Airlines Corporation, New Delhi
SHRI M. N. ARORA (*Alternate*)	

(*Continued on page* 2)

© *Copyrighi* 1980
INDIAN STANDARDS INSTITUTION
The publication is protected under the *Indian Copyright Act* (XIV of 1957) and reproduction in whole or in part by any meant except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

(*Continued from page* 1)

Members	*Representing*
SHRI B. D. JOSHI	All India Trade Union Congress, New Delhi
SHAI S. H. KAMAT	All India Manufacturers' Organization, Bombay
SHRI KARAN SINGH	Indian National Trade Union Congrcss, New Delhi
SHRI AJAY KAUL (*Alternate*)	
SHRI A. R. KESUAVA MURTMY	Minstry of Communication, New Delhi
SHRI P. KRISHNAN NAIR	The Fertilizers and Chemicals Travancore Ltd, Udyogamandal
SHRI P. N. MEHROTRA	Standing Fire Advisory Committee (Ministry of Home Affairs), New Delhi
SHRI G. B. MBNON (*Alternate*)	
SHRI I. N. MURTHY	Chief Controllerate of Explosives, Nagpur
SHRI CHARANJIT LAL (*Alternate*)	
SHRI B. K. NARAYANA BHAGWAN	Hindustan Aeronautics Ltd, Bangalore
DR N. M. PANT	The Safety First Association of India, Bombay
SHRI V. K. MURTHY (*Alternate*)	
SHRI C PAREIRA	Safety Appliances Manufacturers Association, Bombay
SHRI HEATHCLIFF VAZ (*Alternate*)	
SHRI S. RAGHAVAN	Ministry of Shipping & Transport
SHRI S. G. RANADE	Directorate General of Ordnance Factories, Calcutta
SHRI S. R. C. RAO	Bhilai Steel Plant (SAIL), Bhilai
SHRI P. R. ROY	Central Mining Research Station (CSIR), Dhanbad
SHRI T. S. KUMAR (*Alternate*)	
SHRI I. C. SARIN	Employees State Insurance Corporation, New Delhi
DR K. M. SAXENA (*Alternate*)	
SHRI P. SESHADRI	Ministry of Petroleum & Chemicals, New Delhi
SHRI JAGJIT SINGH (*Alternate* I)	
SHRI P. C. EASAW (*Alternate* II)	
SHRI D. K. SIRKAR	Indian Chemical Manufacturers' Association, Calcutta
SHRI P. R. SURENDRANATHAN	National Safety Council, Bombay
SHRI N. C. MUKHERJEE (*Alternate*)	
SHRI P. K. THAKUR	Indian Road Congress. New Delhi
SHRI G. VISHWANATHAN (*Alternate*)	
SHRI S. VENKASWAMY	Directorate General of Civil Aviation, New Delhi
DR HARI BHAGWAN Director (Chem) (*Secretary*)	Director General, ISI (*Ex-Officio Member*)

Safety Equipment Subcommittee, ISAC/S-2

Converner	
SHRI D. M. DHAR	Durgapur Steel Plant (SAIL), Durgapur
Membert	
SHRI J. J. ADHIA	Century Spinning and Manufacturing Go Ltd Bombay
SHRI M. V. RAO (*Alternate*)	

(*Continued on page* 13)

Indian Standard

SPECIFICATION FOR CARBON MONOXIDE FILTER SELF-RESCUERS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 30 June 1980, after the draft finalized by the Industrial Safety Advisory Committee had been approved by the Executive Committee.

0.2 Filter self-rescuer (an escape type gas mask) is designed to provide greatest possible respiratory protection to the wearer for a specified period of tune against sudden exposure to highly toxic carbon monoxide gas which is generally produced in a mine after an explosion or fire. However, it should be carried at all times by workers while working at such places underground where there is a possibility of exposure to carbon monoxide. This has been kept in view while making this standard. It is essential that the respiratory protective device is tested suitably in the laboratory under simulated conditions, and defects, if any, removed so that desired protection is afforded during actual use. This standard is intended to achieve these objectives.

0.3 Since carbon monoxide filter self-rescuers are essential for mines' safety, therefore, they should be maintained properly and the related persons trained suitably for their use.

0.4 In the preparation of this standard reference has been made to the following publication:

> US Department of Interior, Bureau of Mines. Respiratory Protective Devices, 1972. Vol 37, No. 59, Part II.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with 1S:2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

---

*Rules for rounding off numerical values (revised).

1. SCOPE

1.1 This standard prescribes the requirements and methods of sampling and test for filter self-rescuers meant for use for protection against an atmosphere containing carbon monoxide gas with particulate contaminants

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 8347-1977* and the one given below shall apply.

2.1.1 *Filter Self-Rescuer* — An equipment designed for escape from an atmosphere containing not more than one percent by volume of carbon monoxide but having adequate supply of oxygen to permit the wearer to escape to fresh air zone within a specified period of 60 minutes without any significant strain on his respiratory system.

3. REQUIREMENTS

3.1 Description — Filter self-rescuers shall be a complete apparatus including components as given in **3.3**. It shall consist of a carrying case and the filter (internal part). The filter shall contain various layers of chemicals which shall provide carbon monoxide free air to the wearer. It shall be an escape gas mask providing protection against carbon monoxide (maximum concentration — one percent *v/v*).

3.2 Shelf Life — The filter self-rescuers shall at no time gain in mass by more than 12 grams at which stage it shall be considered to have lost its effectiveness. This gain in mass shall not take place in less than 4 years from the date of manufacture.

NOTE 1 — The filter self-rescuers (both mechanical and vacuum sealed) shall be weighed for checking the above requirement at least every three months to determine the gain in mass, unless exempted by the statutory authority.

NOTE 2 — Further, if a vacuum sealed self-rescuer is found to have opened, it shall be weighed immediately, and if found within the limits, then should be re-sealed as per manufacturer's instructions.

3.3 Components — A filter self-rescuer shall, where its design requires, contain the following parts: (a) a mouthpiece and a nose clip with associated attachment to the canister; (b) a canister; (c) inhalation valve and exhalation valve; (d) a container; (e) a heat exchanger; and (f; carrying device. The provision of inhalation valve is not mandatory.

---

*Glossary of terms relating to respiratory protective devices.

These components shall be made from suitable materials with good workmanship.

3 .4 Design and Construction

3.4.1 The filter self-rescuer shall be designed and constructed with good engineering and scientific principles including safety, distribution of mass, durability, practicability of wearer's use including comfort, fit of mouth piece and nose clip, and performance during use including any adverse effect on the wearer caused by heat of reaction produced by the chemicals.

3.4.1.1 *Easy opining* — The design of filter self-rescuers should be such that it enables the wearer to open it quickly without the use of any tools. Further, in the event of accidental jamming of lower portion of the outer case, it should still be possible to use the filter self-rescuer.

3.4.2 The materials used in the construction of the filter self-rescuer (canister and parts in touch with canister) shall be able to withstand a temperature of 150°C for 10 minutes without generating any harmful, foul smell of vapours or gas, and shall not deform or decompose at that temperature. However, rubber parts at the neck of the canister are not intended to be covered by this requirement.

3.4.3 The mass of the complete filter self-rescuer shall not exceed 1 200 g and the mass of the filter shall not exceed 700 g.

3.4.4 *Functional Parts*

3.4.4.1 All parts shall be so designed, constructed and fitted that they will not create any hazard to the wearer. The parts in contact with the body shall be non-irritating.

3.4.4.2 The filter self-rescuer shall be constructed so that it is not damaged by normal handling throughout the period of its life and use. There shall be no deterioration of any of the components while the filter self-rescuer is retained in an air tight container.

3.4.4.3 All materials used in construction of mouth piece and nose ch'p shall withstand the specified tests (*see* **4**).

3.5 Containers

3.5.1 The container shall be strong and shall bear the required markings (*see* **5.1**). It shall be completely leak proof.

3.5.2 The containers shall be so locked by a seal that the seal can be broken rapidly when it is required to open the filter self-rescuer. The design shall be such that the locking device cannot be opened inadvertently, and when open, it should be obvious by visual examination.

3.6 Nose Clip

3.6.1 The nose clip shall be comfortable to wear and capable of being easily fitted by the wearer. The nose clip shall seal the nose against gases and shall not slip during use.

3.6.2 Nose clip shall be adequately attached to the mouth piece or the body of the rescuer to prevent its accidental loss.

3.7 Valves

3.7.1 Inhalation valve or some other means may be provided to prevent exhaled air from adversely affecting the canister. The valve, if provided shall be protected against distortion or damage.

3.7.2 An exhalation valve shall be provided with a cover for its protection. The cover shall provide a dead air space to prevent inward leakage of contaminated air.

3.7.3 The exhalation valve shall function irrespective of the position of the wearer, for example, whether the wearer is in an upright, crawling or in horizontal position.

3.7.4 When the wearer is walking or crawling, the saliva which drains from the mouth piece shall be prevented from entering the filter.

3.7.5 The materials used in the construction of the valve shall not deteriorate or be capable of adhering to the valve seat during storage.

3.8 Filters — The filter self-rescuer shall be fitted with a coarse dust filter and a fine dust filter on inlet side and a dust filter of an incombustible material on the outlet side of the chemical discs.

3.9 Month Piece

3.9.1 The mouth piece which shall have teeth bites shall be capable of being held in wearer's mouth for a period of up to one hour without undue discomfort and shall be so designed that pressure from the wearer's mouth cannot close the air inlet. The mouth piece shall be so fabricated that during inhalation all air for respiration is drawn through canister only.

3.9.2 The mouth piece shall be so shaped that the self-rescuer shall not fall out of the wearer's mouth when the lips are relaxed.

3.10 Head Harness

3.10.1 Head harness shall be provided for extra safety and support so that the filter self-rescuer does not exert any undue load on the wearer's month or tend to shake the mouth piece loose while he is walking or crawling.

3.10.2 The head harness shall be sufficiently elastic to permit the wearer to fit it on the back of his head easily and securely.

4. TESTS

4.1 Breathing Resistance Test — Resistance of the complete respirator to air flow shall be measured at the mouth piece before and after each test conducted in accordance with 4.3 with air flowing at a continuous rate of 85 1/min. The maximum allowable resistance shall be as given below:

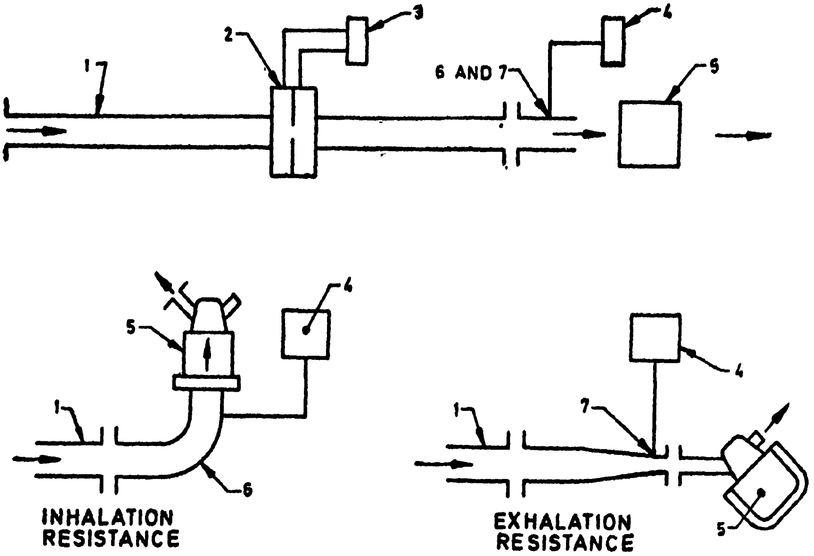
Inhalation Resistance		*Exhalation Resistance*
Initial	Final	
65 mm H_2O	80 (after 60 minutes) mm H_2O	20 mm H_2O

4.1.1 The test may be carried out on an apparatus shown in Fig. 1. A steady air stream of 85 1/min is aspirated through the apparatus. The flow is set by means of a standard diaphragm and a fine manometer.

4.1.1.1 The inhalation resistance is measured with a manometer after attaching the mouth piece of the rescuer (with its exhalation valve sealed) to the apparatus via a suitable connector. Any blank value (arising from the shape of the connector) shall be subtracted from the result. The inhalation resistance is determined immediately before the test and not later than 30 seconds after the test carried out in accordance with **4.3.2.**

4.1.1.2 The exhalation resistance is measured in a similar manner on a ready-for-use rescuer connected to the apparatus by means of a suitable connector. The result shall be corrected for any zero error arising from the shape of the connector.

4.1.1.3 A continuous measurement of breathing resistances during the test described in **4.3.2** may also be used.



1. Measuring Duct
2. Restrictor
3. Differential Pressure Meter
4. Device for Measuring Micro-pressure
5. Self-rescuer
6. Connecting Pipe for Measuring Inhalation Resistance
7. Connecting Pipe for Measuring Exhalation Resistance

FIG. 1 TYPICAL TEST RIG FOR MEASUREMENT OF BREATHING RESISTANCE

4.2 Exhalation Valve Leakage — Dry exhalation valve and valve seat shall be subjected to a suction of 25 mm H_2O while in normal operating condition. Leakage between valve and valve seat shall not exceed 30 ml/minute of air.

4.3 Bench Tests

4.3.1 A typical test rig for testing each canister is shown in Fig. 2. It consists basically of a lung simulator machine with valves controlled by the lung; humidifiers; the test-chamber; the standard test connector (shown in Fig. 3); flow meters for air and carbon monoxide; the exhaust fan and tett and sampling points. The test rig operates on the following principles:

a) The filter ' breathes ' through the lung simulator machine. The filter is placed in a box (chamber) 30 cm long, 30 cm wide and 26 cm high. The air flow past the filter should be at least 100 1/min.

b) The admixture of carbon monoxide is by means of a regulating valve and a flow meter. The carbon monoxide concentration is monitored with a continuous analyser or by repeated check tests. In order to enrich the test gas with water vopour, it is passed through a humidifier. Psychrometric measurements arc carried out to ensure that the prescribed water vapour content of the gas is maintained. The temperature of the test gas should be approximately 25°C.

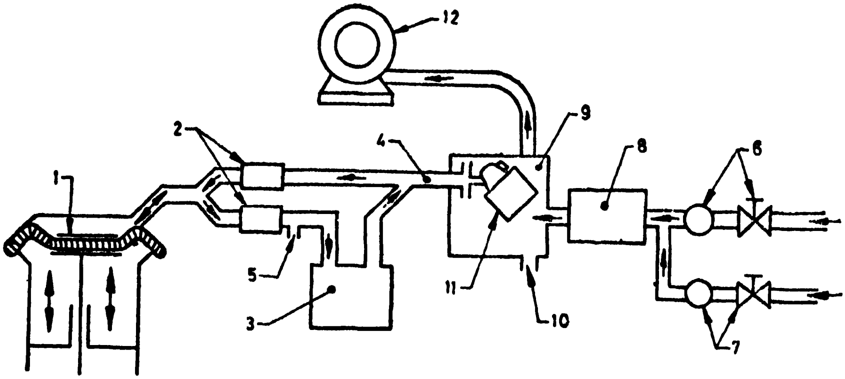
c) The filter self-rescuer is attached to the standard connector. The gas temperature is measured in the connector at the specified point, with a thermocouple.

d) The exhaled air should have a temperature of 37°C and be saturated with water vapour. This temperature is measured before starting the test (at the same point in the connector as for the inhaled air temperature). The contact thermometer regulating this temperature is adjusted by separating the test rig from the lung simulator machine, closing the inhalation path (for example with a bung) and passing a constant 30 1/min air stream through the exhaled air line.

e) The volume of the test rig measured between the connection of the lung simulator machine and the mouth piece of the self-rescuer, should not exceed 2 litres. Wherever possible, rigid tubing should be used to connect together different parts of the test rig. The setting of the lung simulator machine to the prescribed breathing volume is made with a gas meter (volume meter) connected into the system in series with a flow restrictor. This restrictor must have a value of 8.0 mbar in a constant air stream of 94 1/min.

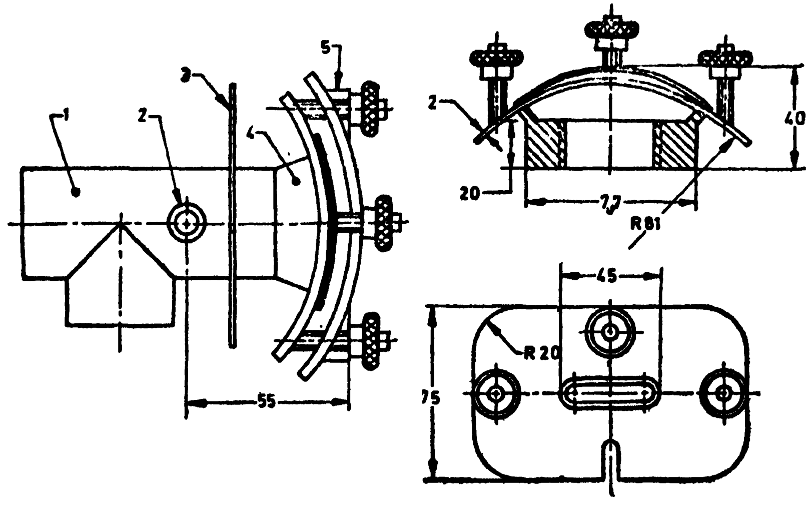
4.3.2 When tested with a lung simulator machine, temperature of the inhaled air measured at or in the mouth piece shall be not more than 63°C at carbon monoxide test concentration of 1.5 percent.

The measurement of inhaled air temperature is made as described in **4.3.1** at carbon monoxide concentration of 1.5 percent in the mixture and moisture content of 20.7 mg/1.



1. Lung Simulator Machnic
2. Solenoid Valves
3. Humidifier for Exhaled Air
4. Connector with Thermocouple
5. Sampling Point for Carbon Monoxide in Inhaled Air
6. Metering and Control Unit for Air
7. Metering and Control Unit for Carbon Monoxide
8. Humidifier for Test Gas
9. Test Chamber
10. Sampling Point for Test Gas
11. Fitter Self-Kescuer
12. Exhaust Fan

FIG. 2 TYPICAL TEST RIG FOR BENCH TEST



1. Plastics T-*Picce* (2.5 cm)
2. Temperature Measuring Point
3. Wall of Test Chamber
4. Connector
5. Clamp

FIG. 3 STANDARD TEST CONNECTOR

4.3.3 Test the sample (*see* **6.1**) as per Table 1. The total amount of carbon monoxide penetrated through the filter bed shall not exceed 100 ml during 60 minutes of test period and the effluent carbon monoxide concentration shall not exceed 100 ppm at any time during the test.

TABLE 1 BENCH TEST FOR CARBON MONOXIDE FILTER SELF RESCUER

SL No.	RELATIVE HUMIDITY	CARBON MONOXIDE CONCENTRATION	FLOW RATE (20 CYCLES/ MINUTE)	TEMPERATURE OF TEST GAS	No. OF TESTS
(1)	(2)	(3)	(4)	(5)	(6)
	percent	ppm	1/min		
i)	95 ± 3	10 000	30	27°C	3
ii)	95 ± 3	5 000	30	Lesf than 3°C	3
iii)	95 ± 3	2 500	30	27°C	3

4.4 Water Vapour Tightness Test for the Filter — Place the filter into a water bath maintained at 80°C for 9 hours. Then place it in a water bath at room temperature for 15 hours. Repeat this cycle five times. Following the above operations, place the filter in a water bath at room temperature for another 50 hours. Then weigh the filter.

The filter self-rescucr shall be taken to have passed if the mass of the filter does not increase by more than 5 g.

4.5 Rattle and Impact Test — Subject the self-rescuer to 50 000 impacts in a suitable vibrating machine which shall give a fall of 20 mm at the rate of 80 to 100 falls per minute. Place the self-rescuer in the machine on a metal plate only without fastening. Place one self-rescuer each in the horizontal, vertical and up-side-down positions. After subjecting the self-rescuers to 50 000 impacts, test them for the requirements for carbon monoxide penetration (*see* Table 1), easy opening (*see* **3.4.1.1**) and breathing resistance test (*see* **4.1**).

5. MARKING

5.1 The outer container shall be marked with the following:

a) Name and trade mark of the manufacturer;

b) Colour prescribed in IS : 8318-1977* for air purifying canisten and cartridges,

c) The words ' for protection against atmospheres containing not more than 1 percent by volume of carbon monoxide ',

d) Instructions against use in an atmosphere containing less than 16 percent by volume of oxygen.

5.1.1 The canister shall also be marked with the words ' Canister for carbon monoxide only'.

5.1.2 The outer container shall be marked by punching or engraving, with the following information:

a) Month and year of manufacture;

b) Mass at the time of manufacture; and

c) Identification number.

5.1.3 The self-rescuers may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Insdtution.

6. SAMPLING

6.1 Samples shall be drawn at random from each batch of production by a competent authority and tested for compliance with the requirements of this specification before actual use. The number of samples drawn should be in the proportion of 3 : 100, but in no case it should be less than three self-rescuers.

---

*Colour identification markings for air-purifying canisters and cartridges.

(*Continued from page* 2)

Members	***Representing***
SHRI K. BARDHAN	Ministry of Defence (DGI)
SHRI J. P. AGARWAL (*Alternate*)	
SHRI K. N. BHATTACHARYA	The Safety First Association of India (Bihar Branch), Jamshedpur
SHRI N. K. SARAN (*Alternate*)	
SHRI N. C. BRAHAMA	Indian Chemical Manufacturers' Association, Calcutta
SHRI A. DAS GUPTA	Adigee Industries, Calcutta
SHRI B. DAS GUPTA (*Alternate*)	
DR A. K. GUPTA	Central Mining Research Station (CSIR), Dhanbad
SHRI P. R. ROY (*Alternate*)	
SHRI P. P. JAIN	Mines Service Corporation, Asansol
SHRI A. P. AGARWALA (*Alternate*)	
JOINT DIRECTOR (MINES SAFETY EQUIPMENT)	Directorate General of Mines Safety, Dhanbad
SHRI S. S. MAZUMDAR	Indian Oxygen Ltd, Calcutta
SHRI K. C. KARMARKAR (*Alternate*)	
SHRI N. C. MUKHERJBE	National Safety Council, Bombay
SHRI N. RAGHAVAN (*Alternate*)	
SHRI I. N. MURTY	Chief Controllerate of Explosives, Nagpur
SHRI CHARANJIT LAL (*Alternate*)	
DR M. PANCHOLY	National Physical Laboratory (CSIR), New Delhi
SHRI C. PEREIRA	Joseph Leslie & Co, Bombay
MRS C. LESLIE ROY (*Alternate*)	
SHRI S. G. RANADE	Directorate General of Ordnance Factories, Calcutta
SHRI GAUTAM V. SHAH	Safety Equipment Corporation, Bombay
SHRI J. V. SHAH (*Alternate*)	
SHRI S. D SHROFF	Pradeep Safety Pvt Ltd, Bombay
SHRI LAL SAJNANI (*Alternate*)	
SHRI D. K. SIRKAR	Synthetics and Chemicals Ltd, Bareilly
SHRI P. R. SURENDRANATHAN	Directorate General of Factory Advice Service and Labour Institutes (Ministry of Labour), Bombay
SHRI M. K. MALHOTRA (*Alternate*)	
SHRI FRANCIS LESLIE VAZ	Francis Leslie & Co, Bombay
SHRI HEATHCLIFF VAZ (*Alternate*)	

Panel for Respiratory Protective Equipment, ISAC/S-2/P1

Convenor	
DR A. K. GHOSH	Central Mining Research Station (CSIR), Dhanbad

Members	
SHRI R. N. MUKHERJEE (*Alternate* to Dr A. K. Ghosh)	
SHRI PROMODE BHARGAVA	Industrial Medical Engineers, New Delhi
SHRI S. P. BHARGAVA (*Alternate*)	

(*Continued on page 14*)

***Continued from page* 13)**

Members	***Representing***
SHRI D. M. DHAR	Durgapur Steel Plant (SAIL , Durgapur
SHRI DURGESH CHANDRA	Century Rayon, Kalyan
SHRI JAYANT ADHIA (*Alternate*)	
SHRI P. GOENKA	Nanda Miller Co, Calcutta
SHRI J.P. GOENKA (*Alternate*)	
SHRI P. P. JAIN	Mine Service Corporation, Asansol
SHRI A. P. AGARWALA (*Alternate*)	
JOINT DIRECTOR	Directorate General of Mines Safety, Dhanbad
SHRI S. C. KALE	Central Labour Institute, Bombay
SHRI M. K. MALHOTRA (*Alternate*)	
SHRI S. K. MUKHERJEE	Mines Safety Appliances Ltd, Calcutta
SHRI M. MISHRA (*Alternate*)	
SHRI C. PEREIRA	Joseph Leslie & Co, Bombay
SHRI R. R. RAMODURAI	Fertilizer Corporation of India (Planning Development Division), Dhanbad
SHRI H. C. ROY CHOWDHURY	Directorate General of Civil Aviation, New Delhi
SHRI S. D. SHROFF	Pradeep Packagers, Bombay
SHRI LAL G. SAJNANI (*Alternate*)	
SHRI HEATHCLIFF VAZ	Francis Leslie & Co, Bombay
SHRI FRANCIS VAZ (*Alternate*)	

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N = 1 kg. m/s^2
Energy	Joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	Siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V - 1 W/A
Pressure, stress	pascal	Pa	1 Pa - 1 N/m^2

INDIAN STANDARDS INSTITUTION

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones : 26 60 21, 27 01 31 **Telegrams : Manaksanstha**

Regional Offices:

		Telephone
Western : Novelty Chambers, Grant Road	BOMBAY 400007	37 67 29
Eastern : 5 Chowringhee Approach	CALCUTTA 700072	27 50 ???0
Southern : C.I.T. Campus, Adyar	MADRAS 500020	41 24 49

Branch Offices:

'Pushpak', Nurmohamed Shaikh Marg, Khanpur	AHMADABAD 380001	2 03 91
'F' Block, Unity Bldg, NaraslmharaJa Squars	BANGALORE 560002	2 76 49
Gangotri Complex, Bhadbhada Road, T.T. Nagar	BHOPAL 462003	6 27 16
22E Kalpana Area	BHUBANESHWAR 751014	6 36 27
Ahlmsa BIdg, SCO 82-83, Sector 17C	CHANDIGARH 160017	2 83 20
5-8-56C L. N. Gupta Marg	HYDERABAD 500001	22 10 33
d-277 Todarmal Marg, Banlpark	JAIPUR 302006	5 98 32
117/418 B Sarvodaya Nagar	KANPUR 208005	5 12 72
PatlIputra Industrial Estate	PATNA 800013	8 28 08
Hantex BLdG (2nd Floor), Rly Station Read	TRIVANDRUM 685001	32 27

Printed at Neelkamal Printers, Delhi, India